

AMENDMENT TO THE CLAIMS

The following listing of claims replaces all prior versions and listings in the application:

Listing of Claims:

1. (Currently Amended) A complex sigma-delta modulation method, comprising:
receiving an input signal;
mixing the input signal with oscillator signals to produce a complex asymmetric input signal having a real component and an imaginary component;
applying a first complex sigma-delta modulation process to the complex asymmetric input signal to produce a first sigma-delta modulated signal;
applying a second complex sigma-delta modulation process to the first sigma-delta modulated signal to produce a second sigma-delta modulated signal, the first and second complex signal sigma-delta modulation processes each including real integration processes; and
conditioning the first and second sigma-delta modulated signals using a complex noise cancellation process to produce an output signal.
2. (Original) The complex modulation method of claim 1, the first and second complex sigma-delta modulation processes each comprising multiple-order sigma-delta modulation processes.
3. (Previously Presented) The method of claim 1, the receiving step comprising receiving a radio frequency modulated signal.

4. (Previously Presented) The complex modulation method of claim 3, the mixing step comprising:

mixing the radio frequency modulated signal with first and second quadrature local oscillator signals to produce the complex input signal.

5. (Currently Amended) An analog-to-digital converter, comprising:

an input for receiving an input signal;

a mixer for mixing the input signal with oscillator signals to produce a complex asymmetric input signal having a real component and an imaginary component;

a first complex sigma-delta modulator, including a real integrator, for modulating the complex asymmetric input signal to produce a first sigma-delta modulated output signal;

a second complex sigma-delta modulator, including a real integrator, coupled to the first complex sigma-delta modulator, for converting the first sigma-delta modulated signal into a second sigma-delta modulated signal; and

a complex digital noise cancellation circuit, coupled to the first and second complex sigma-delta modulators, for canceling quantization noise and to produce a converter output signal from the first and second sigma-delta modulated output signals.

6. (Canceled)

7. (Original) The analog-to-digital converter of claim 5, the first complex sigma-delta modulator comprising a multiple-order sigma-delta modulator circuit.

8. (Canceled)
9. (Original) The analog-to-digital converter of claim 5, the second complex sigma-delta modulator comprising a multiple-order sigma-delta modulator circuit.
10. (Canceled)
11. (Currently Amended) A complex modulator, comprising:
 - an input for receiving an input signal;
 - a mixer for mixing the input signal with oscillator signals to produce an asymmetric baseband input signal having a real and an imaginary component;
 - a complex analog-to-digital converter for converting one of the real and imaginary components of the asymmetric baseband input signal into a quantized real output signal and a quantized imaginary output signal, the complex analog-to-digital converter comprising,
 - a first complex sigma-delta modulator, including a real integrator coupled to the first complex sigma-delta modulator, for converting the first sigma-delta modulated signal into the quantized real output signal and the quantized imaginary output signal, and a second complex sigma-delta modulator including, a real integrator, coupled to the first complex sigma-delta modulator, for converting the first sigma-delta modulated signal into the quantized real output signal and the quantized imaginary output signal;
 - and
 - a complex digital filter for filtering the complex real and imaginary output signals to produce a real filtered output signal.

12. (Canceled)

13. (Previously Presented) The complex modulator of claim 11, further comprising:

a radio frequency signal receiver for receiving a radio frequency input signal.

14. (Previously Presented) The complex modulator of claim 13, the radio frequency receiver comprising:

an antenna circuit coupled to the mixers for receiving a modulated radio frequency signal,
the mixers converting the modulated radio frequency signal into an asymmetric
baseband signal centered about DC.

15. (Previously Presented) The complex modulator of claim 14, the mixer mixing the
modulated radio frequency signal with first and second quadrature local oscillator signals to
produce the asymmetric baseband input signal.

16. (Currently Amended) A radio frequency receiver, comprising:

an input for receiving a modulated radio frequency signal;

a down converter coupled to the input for mixing the modulated radio frequency signal
with oscillating signals to produce an asymmetric input signal having real and
imaginary components;

an analog to digital converter coupled to the down converter, comprising:

a first stage including a complex sigma-delta modulator, including a real
integrator, and having a first stage output; and

a second stage coupled to the output of the first stage including a complex sigma delta modulator, including a real integrator, and having a second stage output; and

a complex digital noise cancellation circuit coupled to the outputs of the first and second stages, for canceling quantization noise and for producing a digitized output signal.

17. (Currently Amended) A radio frequency receiver, comprising:

an input for receiving a modulated radio frequency signal;

a down converter coupled to the input for mixing the modulated radio frequency signal with oscillating signals to produce an asymmetric baseband input signal having real and imaginary components;

a complex sigma-delta analog to digital converter, including a real integrator, coupled to the down converter, for converting only one of the real and imaginary components of the input signal into a complex digitized output signal; and

a complex digital filter coupled to the complex sigma-delta analog to digital converter, for producing a real filtered output signal from the complex digitized output signal.

18. (Previously Presented) The complex modulation of claim 1, the asymmetric signal comprising positive frequencies.

19. (Previously Presented) The complex modulation of claim 1, the asymmetric signal comprising negative frequencies.